Idaho K-2 Mathematics Instructional Supplement

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Introduction

Today, mathematics is more than just computation. It is about reasoning, finding patterns, and trying to make sense of our world. To understand mathematics, our young learners must become problem solvers.

This supplemental booklet was designed to help you, as a teacher of primary grade mathematics, assist your students in discovering the exciting world of mathematics, to become problem solvers. Because we have included items for kindergarten, first, and second grades, teachers may move freely back and forth using the activities to differentiate instruction in order to meet a wide range of needs in their classrooms.

The booklet is designed around the Idaho Mathematics Standards for Kindergarten, First, and Second Grades. We have included activities, connections to children's literature, and references for further exploration into individual mathematical strands. Many of the suggested activities can be introduced in a "whole group, teacher-directed session" which can be moved to a "center or station" for individual practice by the students. Individual practice is necessary for the students to become fluent mathematicians.

It is our hope that you will find this information helpful and interesting for your students as you plan your mathematical lessons.

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Table of Contents

SUGGESTED TEACHING STRATEGIES FOR KINDERGARTEN

SUGGESTED TEACHING STRATEGIES FOR FIRST GRADE

SUGGESTED TEACHING STRATEGIES FOR SECOND GRADE

Suggested Teaching Strategies for Kindergarten

Number Sense

257. Basic Arithmetic, Estimation, and Accurate Computations.

Standard 01: Understand and use numbers.
Content Knowledge and Skills:

a. Demonstrate knowledge of our numeration system by counting in a variety of ways.
b. Demonstrate an understanding of the verbal, symbolic, and physical representations of a number.
c. Identify a penny as a value of money.

Can the student count in a variety of ways?

- Ask the students to join you in counting the number of days in the month, the days you have been in school, the number of boys (girls) in the class today, the number of empty chairs, the number of treats you need for today, etc.
- Ask the students individually to count for you as far as they can count. One-on-one is the only way to find out who knows how to count past 10.
- Do a "grow and shrink" count. Decide together to which number you will count. Ask the students to watch and count with you as you demonstrate. Begin counting to the given number as you raise your body up to a full standing position with arms raised high above your head. Then, starting at the full up position begin shrinking down by counting backwards to the squatting position. Ask the students to squat on their legs as close as they can get to the floor without sitting down or falling over. Count again together. You can count to 3 and back, or 5 and back, or 10 and back. This depends on the ability of your students to count backwards, a much more difficult skill than counting forward.
- Read the book *Ten Black Dots* by Donald Crews, a counting book that shows what can be done with dots: one dot can make the sun, two dots can make the eyes of a fox, three dots can make a snowman's face. Using commercially made dots, students can explore a number by drawing a picture and using the dots to finish one part of the design. Making a classroom book, or several books, of all the numbers to ten will be a good way for students to share this experience.
- Read the book *Each Orange Has 8 Slices: A Counting Book* by Paul Giganti. This book has pages and pages of counting opportunities. It could be used as a page each day for a week or more.

Can the student recognize a number verbally, symbolically, and physically?

- Make overhead numeral cards. Put them one-by-one on the overhead briefly. In unison, have the students quickly call out the names of the numerals they see.
- Provide students with a flat box filled ¼ inch deep with sand or salt and numeral cards for the number of the day. Let them practice writing the numeral in the salt or sand box. One child can hold the numeral card while the other writes. They switch after one numeral is written.
- Provide the students with numeral cards 0-10. Call out a number and have the students choose the correct one from their desktops to hold up in the air. Store them in small zip bags.
- Roll a large die that has dot arrays, not numbers. (These are available commercially or can be made using milk cartons cut down and covered with contact paper.) Show the array on top of the large die to the whole class. Have the students write the numeral for

that array on their white boards to show you, but they should not call out the answer until cued by the teacher.

- Hold up a large numeral card. Have the students put the correct number of connecting cubes on their fingers and silently put their hands in the air until cued by the teacher to call out the answer.
- Get a 3x5 index card. Zig-zag cut it apart. On one half write the numeral, and on the other half make an array to match the numeral. You can make other seasonal sets using the numeral and tiny stickers used for incentive charts. Be sure each zig-zag is unique and different from all the others in the set. Store them in small zip bags.
- Make dot cards in the domino pattern. Show the students the card for one second. This is an instant recognition task. The teacher can also make other cards in varying patterns. Instant recognition of number is expected for numbers zero to six, but not for larger numbers. (Richardson, 1999. Book 1)

Can the student recognize and name a penny?

- Provide pennies for the entire class. Give pairs of students a magnifying glass to examine their pennies. Have them try to find differences between the pair of students' pennies. Trade pennies with another pair of students and look again.
- Practice picking up pennies out of a pile of other coins while naming the coin.
- Use pennies as a manipulative for students to count to ten and backwards from ten while saying, "One cent, two cents, three cents, etc."
- Learn the poem, "Penny, penny, easily spent. Round and brown and worth one cent."

Standard 02: Perform computations accurately.
Content Knowledge and Skills:
a. Explore the concepts of addition and subtraction using concrete objects.
b. Use appropriate vocabulary (how many, counting, next).

Can the student explore addition and subtraction using manipulatives?

- Begin the addition and subtraction processes by telling stories. The students can act out the stories using materials that are readily available in the room.

  Addition example: Judy put two books on the table. Lucy put two more books on the table. How many books are on the table now? (adding)

  Subtraction example: Lois, David, Scott, and Lani are working together at the sand table. Lani leaves because her mother has come to get her early. How many children are still working at the sand table? (Richardson, 1999. Book 1)
- Use connecting cubes or other counting devices to tell stories to each other. These stories may be fantasy stories using the counters as people, horses, etc. Or, you may want to make drawings of trees or barns that the students can use to tell their stories to carry the theme of your week into mathematics.

Can the student use the vocabulary of computation?

- You may also want to have a paper birthday cake drawn on a piece of 9 x 12 white paper that you can use to show "candles" for the birthday person. If the child is given the paper earlier in the day, he or she could color it before the "math" lesson. The candles could be real candles (not to be lit), sticks, toothpicks, etc. Ask the child how many candles belong on the cake. Then say, "Count out loud as *child's name* puts the candles on the cake." As each candle is put on the paper cake, say, "What comes next?" That person might want to "blow out the candles" as you (or the birthday person) remove

them one-by-one from the cake. This is a good way to practice counting backwards. You can also stop after each candle is blown out and say, "How many candles are left?" (subtracting)

Standard 03: Estimate and judge reasonableness of results.
Content Knowledge and Skills:

a. Use estimation to identify a number of objects.
b. Evaluate the reasonableness of an answer.
c. Use appropriate vocabulary (how many, estimate).

Can the student use estimation to identify a number of objects?

- Kindergarteners can begin to estimate if you use numbers that are not too large. Use a peanut butter or olive jar that will hold about 20 objects. Put less than 10 connecting cubes (or other three dimensional counting objects) in the jar. Ask the students to give you a "thinking guess, an estimate" of about how many cubes are in the jar. Accept one estimate from each child. Write the estimate on the board. Then, count the objects together taking them out of the jar one-by-one. The jar does not have to be full, but could be if needed. Discuss the results.
- Show a jar that would hold less than ten walnuts. Put one walnut in the jar and show it to the students. Ask the students how many walnuts they think it would take to fill up the jar. Take estimates from each child by writing the numbers on the board. Accept all estimates. When all estimates are taken, begin filling the jar with the walnuts. (Richardson, 1999. Book 1)

Can the student evaluate the reasonableness of an answer?

- Using the example given above with the walnuts, count together as you fill the jar. Stop periodically and discuss the estimates that are on the board. Erase the ones that everyone agrees are no longer usable estimates. Students may begin to realize that some of the estimated numbers have already been counted; therefore, are not reasonable. Some will not be counted because they are too large, also not reasonable estimates. By accepting all estimates, you will help the students learn through this weekly experience what a reasonable estimate is. Overreacting to a "wild" estimate (offered as entertainment) is the surest way to encourage additional and "wilder" estimates. Simply move on unemotionally after writing *1 m* for 1 million, etc. (Richardson, 1999. Book 1)

Can the student use the vocabulary of estimating?

- By estimating on a regular basis, at least once a week, the students will naturally begin to use this particular language of mathematics. Begin by using the word "guess" and transition to the term "thinking guess." Use "thinking guess" interchangeably with the word "estimate" until the students are comfortable with both terms.

Measurement

259. Concepts and Principles of Measurement.

Standard 01: Understand and use U.S. customary and metric measurements.
Content Knowledge and Skills:

a. Explore the use of standard and non-standard tools for measuring time, length, volume, weight, and temperature.
b. Apply estimation of measurement to real-world and content problems using actual measuring devices.
c. Use appropriate vocabulary (days of the week, names of the months, calendar, shortest, longest, smallest, largest).

Can the student use standard and non-standard tools to measure?

- Write names of the students on tongue depressors and keep them in a decorated soup can. Pull out two names. Have those students come to the front of the room for the task. Then ask, "Who is taller? Who is shorter?" Have the class discuss what they see.
- Provide a balance scale and various classroom objects such as a stapler, pencil, eraser, etc. Have the students compare the two objects using the terms heavier and lighter.
- Use the balance scale and rice-filled film canisters as weights to measure assorted objects. Put the object to be measured on one side of the balance scale and continue to add the rice-filled film canisters to the other side until it balances.
- Have the students measure assorted small objects in the classroom using paper clips laid end-to-end.
- Gather assorted measuring tools such as: ruler, yardstick, bathroom scale, balance scale, clock, thermometer, measuring cups, pints, quarts, etc. Ask questions such as: "Which tool you would use to measure the temperature?" "…to measure the time?" "…to measure your friend's height?"
- During calendar time, encourage the students to chant or sing songs that teach the days of the week. You can use the song *Alouette* to sing the days of the week. "Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and then we start again."
- To teach the months of the year and encourage students to learn the months in which they were born, use this poem.

  Cows in the barnyard,
  Sheep in the corn.
  Jump on the month
  That you were born.

  Then begin chanting (like a jump rope jingle) the months of the year encouraging the January children to jump up when everyone calls January, etc.

Can the student apply estimation of measurement to real-world and content problems using measuring tools?

- Provide an assortment of plastic containers, measuring cups, and a large container of beans. Have the students estimate how many ½ cups it will take to fill the different containers with beans and check their predictions by measuring.

Can the student use the language of measurement?

- While using measurement activities, encourage the students to use appropriate mathematical vocabulary such as: shortest, longest, smallest, largest, days of the week, months of the year, and calendar.

Patterns / Algebraic Thinking

260. Concepts and Language of Algebra.

Standard 01: Use algebraic symbolism as a tool to represent mathematical relationships.
Content Knowledge and Skills:
a. Compare sets of objects using vocabulary (less than, greater than, same as).
b. Explore the relationship between addition and subtraction.

Can the student compare sets of objects using the appropriate vocabulary?

- Have the students build number trains of two different lengths by saying, "Build a blue train that is four cubes long." After they build that train say, "Build a yellow train that is six cubes long." Ask the students to compare the trains by saying to them, "Show me the train that has more." Then, "Show me the train that has less." (Richardson, 1999. Book 1)
- If the above activity is easy, have them build several trains that have less than ten cubes. Give them a number and say, "Show me a train that has more than six." "Show me a train that has less than six. Have the class state the relationship between the trains such as: "Four is less than six. Six is more than four. Repeat with trains of various lengths. You can vary the tasks and language to include greater than and the same as. (Richardson, 1999. Book 1)

Can the student explore the relationship between addition and subtraction?

- Have the students act out stories using real objects in the classroom. See 257 Number Sense, Standard 02 for suggestions.

263. Functions and Mathematical Models.

Standard 01: Understand the concept of functions.
Content Knowledge and Skills:
a. Replicate and extend patterns and identify the rule (function) that creates the pattern.
b. Sort and classify objects by attributes.
c. Understand and use appropriate vocabulary (pattern, sort).

Can the student replicate and extend patterns?

The following three tasks are a sequential set of activities.

- Begin with a rhythmic pattern. Ask the students to join you in doing the motions after a few repetitions of the pattern. Example: slap (thigh), clap, clap; slap, clap, clap; slap, clap, clap. With this task, everyone is doing the motions only.
- Continue with rhythmic patterns adding a word (in unison) to describe one motion, but continuing to do all the motions. Say, "Slap, __, ___; slap, ___, ___; slap, ___, ___. With this task, everyone is doing the motions, but adding the word "slap" as the motion is done.
- Continue the rhythmic pattern adding all the words (in unison). Say and do the pattern, "Slap, clap, clap; slap, clap, clap; slap, clap, clap. With this task, everyone does all the motions and says the accompanying words.
- Read the book *Pattern* by Henry Pluckrose. Go on a "pattern walk" to find examples of patterns in the environment and in the school. Discuss what is found with the students.

Can the student identify the rule that creates the pattern?

- Using a rhythmic pattern, as described above, rename the body parts orally using the alphabet. Example: "head, head, nose, nose; head, head, nose, nose" could be

renamed, A,A, B B; A A, B B while still touching the original body parts. This renaming of the pattern, while doing the motions of touching the named body part, is a progression toward understanding the rule that creates the pattern.

- While continuing to say A A, B B, change to other rhythmic motions to help the students learn to label all patterns of this sequence in a like manner. Examples of other AABB patterns might be: jump up, jump up, bend over, bend over; or, stamp feet, stamp feet, wave arms, wave arms, etc.
- Interpret the patterns created rhythmically by using manipulatives such as connecting cubes, pattern blocks, shells, pebbles, etc. Using the A A, B B pattern in cubes you might see red cube, red cube, yellow cube, yellow cube. But, it would still be called by the AABB name. This is a natural next step after several days of working in a rhythmic pattern mode.
- In a center, have the students create a macaroni necklace using the pattern sequence that they choose. They need to tell you what the pattern is as they are making it.
- Invite students to share a pattern daily at calendar time. You should have the "child volunteer" audition the pattern with you at an earlier time so that you know the pattern is one that will work. They can draw out the pattern for you or do a rhythmic one. The students watch the "child volunteer" for at least two repeats of the pattern. Then, they join the child in repeating the actions for the pattern while chanting the sequence of the pattern.
- **Pattern daily in some way**. Use seasonal pictures, rhythmic patterns, sounds on a xylophone, etc. Pattern is the basis of mathematics.

Can the student sort objects by one attribute?

- Read the book *Sorting* by Henry Pluckrose. In this book, students are introduced to the sorting concept. Show the students a tub of rocks. Ask the students how they would like you to sort the rocks using only two piles. Examples: shiny and not shiny, big and little, bumpy and smooth. Sort the rocks and discuss. You may wish to try another way of sorting that was suggested by the students.
- In pairs, students can sort a tub of shells in the same way that the rocks were sorted. Circulate around the room as the students are sorting. When they have finished, students should raise their hands. Ask the pair of students to tell you how they have sorted. They should answer in unison as you point to each of the piles (example: "Shiny, not shiny.")
- Continue the paired sorting by leaving a connecting cube at the desk where they are sorting. This indicates that they have sorted one time. Scoop up one of the piles and put it back into the tub. Ask the students to sort the remaining pile in another way. Continue to check other children while this pair sorts the new pile differently than the first way.

Can the student use the vocabulary of pattern and sort appropriately?

- Use the words "pattern" and "sort" daily. It is fun to sort students by their attributes such as: hair color, eye color, pants or shorts, sister at home or not, or ride the bus or not. After such a "people sort" then you can pattern the students using their attributes. Ask the students to tell you what pattern you made. Using these words daily will make them part of the students' mathematical language as they work together to solve problems such as these.

Geometry

261. Concepts and Principles of Geometry.

Standard 01: Apply concepts of size, shape, and spatial relationships.
Content Knowledge and Skills:
a. Recognize, name, build, draw, compare, and sort two-and three-dimensional shapes (shape, circle, triangle, square, rectangle).
b. Recognize and create shapes that have symmetry.
c. Explore slides, flips, and turns.
d. Understand and apply appropriate vocabulary for position and size (above, below, up, down, over, under, inside, outside, top, bottom, between, middle, before, after).

Can the student name, build, draw, compare, and sort two and three-dimensional shapes?

- Provide a class set of shapes such as Attribute Blocks. Have the students sort and classify the shapes according to their attributes.
- Give the students a yellow hexagon from the pattern block collection. Have them discover different pattern block pieces that can be laid on top of the hexagon shape to create another hexagon. For example: six green triangles, three blue rhombi, two red trapezoids.
- Tell the following story: "A policeman stopped a driver and asked what he was carrying in a large box on his truck. This was the driver's reply; 'Two squares, one large and one small, one circle, one triangle on a pole, two little rectangles.'" Students draw what might be in the box. (Childs & Adams, 1979)

Can the student recognize and create shapes that have symmetry?

- Find examples of symmetrical objects such as a paper heart folded in half, a circle folded in half, a triangle folded in half, a rectangle folded in half, etc.

Can the student explore slides, flips, and turns?

- Read the book *Shapes* by Henry Pluckrose. Go for a walk around the school looking for different shapes and examples of tessellations such as floor tiles, brick walls, etc. Discuss the properties that make tessellating figures link together with no spaces in between.

Can the student use the language of geometry?

- As the students participate in geometry activities, encourage them to use the vocabulary including words such as shape, circle, triangle, square, rectangle, above, below, up, down, over, under, inside, outside, top, bottom, between, middle, before, and after.
- Give the students a cut out of a worm that is about three inches long and one inch wide. Have them make a face on the worm and decorate it with their crayons. Then, give them a picture of a tree that is on a 9x12 paper. Practice using the vocabulary words such as over, under, inside, outside, top, bottom, etc., as they move Willie the Worm.

Data Analysis and Probability

262. Data Analysis, Probability, and Statistics.

Standard 01: Understand data analysis.
Content Knowledge and Skills:
a. Interpret information from real objects and simple pictographs.
b. Understand and use appropriate vocabulary (graph, predict, tally, most, least, same, sort).

Can the student interpret information from real objects and simple pictographs?

- Provide a graph titled, "Are You Wearing Tie Shoes or Not?" Have the students look for particular parts of the graph, such as: question in the title and columns with the labels at the bottom. Guide them to look at the graph and make comparisons between the columns of information.
- Provide different types of graphs such as picture graphs and tally graphs for students to interpret in a teacher-guided lesson.

Can the student understand and use the language of data analysis?

- As the students use the data analysis activities, encourage them to use language such as graph, predict, tally, most, least, same, and sort.

Standard 02: Collect, organize, and display data.
Content Knowledge and Skills:
a. Create a graph using real objects or pictorial representations.

Can the student create a graph using real objects or pictorial representations?

- Provide a two column floor graph titled "Are You Wearing Tie Shoes or Not?" The graph can be made using an old shower curtain on which a two-column graph is drawn. Have the students remove one shoe to use as a graphing object. Seat the children around the floor graph, leaving space to walk around the graph. One-by-one have them place a shoe in the column labeled **yes** (I do have on tie shoes.) or **no** (I am not wearing tie shoes.) Count and discuss the findings on the graph, such as: 8 people have tie shoes, 10 people do not have tie shoes. There are two more people who do not have tie shoes than do have tie shoes. If two more tie shoes were on the yes column of the graph, the columns would be the same.
- Take snapshots of the students. Glue their pictures to milk cartons that have been cut off three-inches from the bottom. Using these cartons, decided with the class how to sort the students. Sort them by girl/boy, glasses or no glasses, etc. Create a real graph using the cartons with pictures on the sides. Discuss the results. These cartons can be kept and used in the future for graphing other objects that could be chosen and put into the carton, such as: cookies, fruit, etc.
- Have the students bring a snapshot of a pet or of a pet they would like to have. Use a two-or three-column graph to compare the different animal pictures. Together, decide how to sort the pictures: ones with fur or no fur, ones that swim or not, etc. Sort them. Then, create the graph by putting the pictures in the right columns. Discuss the results.

Standard 03: Understand basic concepts of probability.
Content Knowledge and Skills:
a. Predict results and perform simple probability experiments.

Can the student predict, perform, and record results of simple probability experiments?

- Concentrate on the terminology: always (or certain), never (or impossible), or maybe (or possible). Create a set of sentences like the following:
    1. It will snow tomorrow. (maybe)
    2. Flowers will walk to school with us tomorrow. (never)
    3. You will sleep tonight. (always)
    4. You will go to school tomorrow. (maybe)

  Students will respond to the sentences using one of the terms: always, never, or maybe.
- Provide a bag with yellow and blue cubes. Ask the children questions such as, "What will we always pull out of this bag (blue or yellow cubes), what might we pull out of this bag (a blue cube or a yellow cube), what will we never pull out of this bag, (orange cubes, a ball, etc.)" Discuss why those conclusions were made.

Standard 04: Make predictions or decisions based on data.
Content Knowledge and Skills:
a. Make predictions or decisions based on probable results or past experiences.

Can the student make predictions or decisions based on probable results?

- See suggestions in the previous standard.

258. Mathematical Reasoning and Problem Solving

Standard 01: Understand and use a variety of problem solving skills.
Content Knowledge and Skills:
a. Select strategies appropriate to solve a problem.

Standard 02: Use reasoning skills to recognize problems and express them mathematically.
Content Knowledge and Skills:
a. Use concrete objects to identify and show a solution to problems.

Standard 03: Apply appropriate technology and models to find solutions to problems.
Content Knowledge and Skills:
a. Select appropriate models to represent mathematical ideas.

Can the student use mathematical reasoning and problem solving strategies?

- Problem-solving strategies and processes are not so much taught as *modeled*. Your task as a teacher is to suggest appropriate strategies and to point them out to students in class discussions as important ways of doing mathematics. (Van de Walle, 2001)

  The **before** phase: To model problem-analysis skills for your students, first discuss what is known, what is needed, and what is asked for or expected in the task. From this discussion, students will begin to understand that this is an important first step in the problem solving process.

The **during** phase: At this time invite students to contribute their methods for solving the problem. Different students may have different ideas about how to approach the task. All possible strategies should be accepted and respected as part of the learning process. Give students the opportunity to use *their* ideas and not simply follow directions. Trust and encourage the students' creative thinking.

The **after** phase of problem solving should include a discussion highlighting the strategies used to complete the task. By labeling a strategy, students are provided with a useful way to talk about their methods, and the teacher is given a means to provide hints and suggestions.

The **final** phase of problem solving must include modeling the "looking back process" in order to justify the answer, consider how the problem was solved, and look for possible extensions or generalizations. It is important to model this part of problem solving as students will be expected to complete this phase independently in subsequent grades.

- Some of the strategies that are useful for kindergarten students could be: 1) Draw a picture, 2) act it out, 3) use a model, and 4) look for a pattern.

Suggested Teaching Strategies for First Grade

Number Sense

267. Basic Arithmetic, Estimation, and Accurate Computations.

Standard 01: Understand and use numbers.
Content Knowledge and Skills:

a. Demonstrate knowledge of our numeration system by counting in a variety of ways.
b. Read, write, order, and compare whole number to 100.
c. Demonstrate the knowledge of place value through 99.
d. Identify and state the value of pennies, nickels, and dimes.

Can the student count in a variety of ways?

- Using the book *Two Ways to Count to Ten* by Ruby Dee, an African folktale about King Leopold who is searching for the best animal to marry his daughter, you can help students explore skip counting by twos. This can lead to a discussion of counting in other ways such as by fives and by tens.
- Using an adding machine tape, the teacher can record the number of days the students have been in school. Mount the tape in a continuous strip around the room at the top of the board. By recording the tens numbers in red, students can count by 10s with ease.
- Another way to keep track of the days until the 100^{th} day is to provide a pocket chart with 00-99 cards with their backs showing. Each day the students can turn over another card in order to keep track of the days they have been in school.
- Ask the students individually to count for you as far as they can count. One-on-one is the only way to find out who knows how to count past 10. Have them count by twos, fives, and tens to see which of the other series they can successfully complete. They can also count backwards for you from a random number.
- Do a "grow and shrink" count. Decide together to which number you will count. Ask the students to watch and count with you as you demonstrate. Begin counting to the given number as you raise your body up to a full standing position with arms raised high above your head. Then, starting at the full upright position, count backwards while shrinking down to the squatting position. Ask the students to squat on their legs as close as they can get to the floor without sitting down or falling over. Count again together. You can count to 6 and back, or 10 and back, or 20 and back. This depends on the ability of your students to count backwards, a much more difficult skill than counting forward. You can also count in other ways such as by twos, fives, tens, etc.
- Practice counting in a variety of ways by counting in different voices, such as an old person, a very happy person, Goofy, a baby, a dog, etc. Invite the students to give the class ideas for a new voice.

Can the student read, write, order, and compare whole numbers to 100?

- Make overhead numeral cards for the numbers 11-20. Put them briefly one-by-one on the overhead. Have the students quickly call out in unison the name of the numeral they see.
- Provide each pair of students with an open flat box filled ¼ inch deep with sand or salt and a numeral card for the number of the day. Let them practice writing the numeral in the salt or sand box. One child can hold the numeral card while the other writes; they

switch roles after the numeral is written. After practicing the number of the day, continue writing by reviewing the previous days' numeral cards.

- Play the Chain Game with teacher made cards. On a 3"x5" card, write the following information: "I have 19, who has 21?" On a new card write, " I have 21, who has 12?" Continue to write cards having numerals that will be helpful for your students to practice. Many numerals are confusing, so include those as well as others that are not so confusing. Conclude by looping the last card back to the first card, such as, "I have 14, who has 19?" (See the first example.) Make enough cards so that all the students and the teacher have at least one. You will begin, and you will end the loop.
- Play the Chain Game using numbers divisible by two, or five, or ten. Make a new set of cards for each game.

Can the student demonstrate knowledge of place value through 99?

- Arrow math is used to help students understand the relationship between the rows and the columns on the 00-99 chart. Example: Choose a target number such as 15. Choose a beginning place on the chart such as 32. Students can be instructed to go up two rows (^^); then, forward three spaces (>>>) to find the target number. The arrows indicate the direction to move. Students can give their own instructions for arrow math after they have practiced with their teacher.
- Using a tens and ones mat, have the students create a number by using connecting cubes. Write a number on the board. Have the students build that number using the tens and ones. In the beginning, have the students connect the cubes to make the tens. After practicing for several days it may be helpful to make up sets of tens in advance.
- Play "Rearrange-It: Breaking Up Tens" to explore what happens to the total number of cubes when students break trains of tens apart. Students need to understand that the total number of cubes does not change even when they break up their trains of ten. The teacher says, "Put three tens and four ones on your board. How many cubes is that?" The students answer, " Thirty-four." Teacher says, "Break up one ten and put the loose cubes with the ones. How many tens do you have now?" Pause and discuss the answers given. Then ask, "How many ones?" "How many altogether?" Repeat using a variety of numbers. This concept is the foundation for good understanding of what happens to the numbers when regrouping is used during double-digit addition and subtraction. (Richardson, 1999. Book 3)

Can the student identify and state the value of pennies, nickels, and dimes?

- *Math by All Means: Money Grades 1-2* by Sharon Crawford, is a book that is a replacement unit for teaching money.
- Use a group of pennies, or nickels, or dimes, in a small container. With a tablespoon, scoop out one spoonful of coins. Count the value of the coins. When students have mastered counting the same coin, mix pennies and dimes, or pennies and nickels.
- Practice using money by creating a store for students to purchase cans of food. Price the cans using lower prices such as 5 cents, 6 cents, etc. If you open the cans from the bottom, they look like a full can when turned right side up.
- Set up a Valentine Bag supply center where students can purchase supplies to complete the bag. Each child is given a bag and 20 cents for buying decorations. For example: sell glitter for 2 cents a shake, glue for 1 cent a squirt, paper hearts 2 for one cent, stickers for 3 cents each, etc. They can draw a plan and calculate the totals they will need before they begin. This is a good time to practice using a four-function calculator.

- Learn the poem, *A Penny is One Cent*. Chant the whole poem with the class:

  A penny is one cent, (stamp your foot once)
  A nickel is five, (slap your thigh once)
  A dime is ten cents (clap your hands once)
  A quarter - twenty-five. (snap your fingers above your head once)
  How many cents have I on this try?

  Then the teacher creates a combination of motions that represent a collection of coins for the students to identify. Begin with the coin of greatest value. For example: clap, clap, slap, stamp would be dime, dime, nickel, penny. The collection is worth 26 cents. Students raise their hands at this point to state the value of the collection. Although this poem uses a quarter, it is not necessary at the first grade level to include this as part of the lesson. It is needed to make the poem complete and allows the students to learn another coin's name and value.

Standard 02: Perform computations accurately.
Content Knowledge and Skills:
a. Demonstrate proficiency of addition up to 10 and an understanding of subtraction from 9.
b. Use appropriate vocabulary (sum, difference, skip count, is same, facts, ones, tens, add, subtract, equals, number sentence, plus).

Can the student demonstrate proficiency in addition to 10 and subtraction from 9?

- Using the dot cards made for instant recognition of the numbers zero-six, the teacher can create an addition practice game. Hold up one card with a dot array (example: five dots); hold up another card with a dot array in your other hand (example: four dots). Have the students add the two numbers together mentally.
- Using the dot cards and the task as described previously, have the students show the number sentence by using a white board and marker.
- Cut a piece of 9x12 one-inch graphing paper into 4x4 grids. Students fill in their grids randomly using the numbers 2 through 12 repeating numbers as needed. The teacher rolls the dice and announces the numbers rolled. Each player crosses out one number on his or her playing grid that matches the sum of the two numbers. If three and five are rolled, each player crosses out one eight. Play continues until a player has crossed out four in a row in any direction (or in a specific direction). Play can continue until one player gets a blackout, or to see if a second player can get a "Bingo" before the first winner gets a second win. The size of the grid could also be changed to a 5X5 grid.
- Teach the students the addition strategy "make a ten" to help them see number relationships. Given the number sentence 8+3, students should first learn to "make a ten" by breaking the 3 into 2 +1. Add the 2 to 8 making 10. Then, add on the remaining 1 making the sum 11.
- Practice the addition strategy of counting on from the larger number in the equation rather than counting all of each number.
- Practice the subtraction strategy of counting up from the subtrahend to the minuend to find the difference.
- Use the activity "Number-Train Graph" to show the many ways to make each number. Students use connecting cubes to find ways to show equations that make a number. Example: Have the students brainstorm ways to make six. Six could be 1 + 5, 2+4, 0+6, 3+3. Divide a piece of chart paper into four vertical columns and write one equation at the top of each column. Have the students create ways to make each equation using the cubes. Then, they can make paper recordings of their connecting cube trains by using inch graph paper cut in strips. Under the 2+4 column students could put recordings such

as the following: red, red, blue, blue, blue, blue; red, red, blue, blue, red, red; red, blue, red, red, blue, red. Position counts, so all of these are different ways to make 2+4. (Richardson, 1999. Book 2)

- Use edible manipulatives such as fish crackers. Have the students count their items and share some crackers with a friend. Draw a picture and write an equation showing what happened.
- The group stands or sits in a circle. The leader states an incomplete number sentence and tosses the beanbag to a student. After completing the leader's equation, the catcher makes up another problem and tosses the bag to another student. (Childs & Adams, 1979)

Can the student use the language of computation?

- As students complete computation activities, listen for appropriate mathematical vocabulary such as: sum, difference, skip count, is the same as, facts, ones, tens, add equals, number sentence, subtract, and plus.

Standard 03: Estimate and judge reasonableness of results.
Content Knowledge and Skills:

a. Use estimation to identify a number of objects.
b. Use estimation to predict computation results.
c. Evaluate the reasonableness of an answer.
d. Use appropriate vocabulary.

Can the student use estimation to identify a number of objects?

- Fill a clear plastic peanut butter container with chocolate kisses. Have the students estimate how many kisses are in the jar. Write the estimates on the board. Count out half of the kisses. Have the students adjust their estimates if they choose to make a change. Continue counting and discuss the results.
- Send the estimation jar home with the "student of the week." Have that student return the jar with new items to be estimated. Make sure to give guidelines that keep the number reasonable. At the beginning of the year, the number should be less than 20 items, but can be larger (up to 50) by the end of the year. The jar does not need to be filled to the top. The "special" student should count ahead of time so that the number is already known. The items need to be the same size and shape.

Can the student use estimation to predict computation results? *and…*
Can the student evaluate the reasonableness of an answer?

- Present the students with an equation such as 5+4. Give the following three possible sums: 1, 9, 18. Discuss the reasonableness of each sum.
- Use the same type of activity for subtraction practice. For example: Given the equation 11-2 and the differences 4, 9, 13, discuss which one is a reasonable answer.

Can the student use the language of estimation?

- As the students participate in the estimation activities, listen for mathematical terminology such as estimate, reasonable, more, less, etc.

Measurement

269. Concepts and Principles of Measurement.

Standard 01: Understand and use U.S. customary and metric measurements.
Content Knowledge and Skills:

a. Explore the use of standard and non-standard tools for measuring time, length, volume, weight, and temperature.
b. Apply estimation of measurement to real-world and content problems using actual measuring devices.
c. Use a calendar to explore measurement of time.
d. Use appropriate vocabulary (fewest, most, thermometer, temperature, greater than, less than, feet, inches, penny nickel, dime, quarter, cents, hours).

Can the student use standard and non-standard tools for measuring?

- Begin telling time with a one-handed clock. Have the students create analog clocks using paper plates. The students must place the numbers in the correct position. Practice telling time on the hour only. Use approximate kinds of language such as, "It's about 2 o'clock, or it's close to 3 o'clock."
- Label the hands: hour and minute. Practice setting the clock on the hour using both the minute and hour hands. Practice telling the time.
- Make a clock using a student as the clock hands. Make number cards on tagboard for the numbers 1-12. Discuss the placement of the numbers by checking the classroom clock. Lay the numbers on the floor in a large circle around one child who is lying on the floor. Label the child's arms with hour and minute labels. Have the other students move the "clock hands" to practice time on the hour.
- Read *How Big is a Foot* by Rolf Myller. Have each student trace his-or-her foot twice. Let students measure the length of the room using their feet by placing them end-to-end just as the little helper did in the book. Make comparisons found due to the varying lengths of feet.
- Using paper clips, connecting cubes, tongue depressor, tiles, toothpicks, inch and centimeter rulers, have students measure various items in the classroom. Compare different lengths found using the different measuring tools.
- Have students use a balance scale to weigh two items and compare their weights.
- Provide thermometers and containers of water at various temperatures. Ask the students to record the temperature of each container of water and categorize it as hot or cold.

Can the student apply estimation in measurement using actual measuring devices?

- Provide an assortment of plastic containers, ¼ measuring cup, and a large container of beans. Have the students estimate how many ¼ measuring cups it will take to fill the different containers with beans and check their predictions.

Can the student use the calendar to measure time?

- Read *Chicken Soup With Rice* by Maurice Sendak. Have the students construct a calendar for the given month. Add special dates such as birthdays and holidays. Discuss the calendar created. Compare it with the calendar from the previous month.
- Using the daily classroom calendar, ask the students questions such as the following. On what day of the week is the 14^{th}? How many Mondays are in this month? What is the date of the third Tuesday?

Can the student use the language of measurement?

- As the students use the measuring activities, encourage them to use the language of measurement such as heavier, lighter; more than, less than; fewest, most; thermometer, temperature; feet, inches; etc.

Patterns / Algebraic Thinking

270. Concepts and Language of Algebra.

Standard 01: Use algebraic symbolism as a tool to represent mathematical relationships.
Content Knowledge and Skills:
a. Represent vertical notation in horizontal form.
b. Write a number sentence given an addition or subtraction problem.
c. Compare numbers using vocabulary (less than, greater than, equal to, more, less, same, fewer, bigger, smaller)
d. Explore the relationship between addition and subtraction and demonstrate reversal of operations.

Can the student represent vertical notation in horizontal form?

- As the students use notation, have them use both forms interchangeably. Generally, the horizontal form is easier as they begin with that and move to the vertical.

Can the student write a number sentence when given an addition or subtraction problem?

- Tell number stories using the names of the students in your classroom. Write the equations for the stories on the board as you go, explaining how you got the numbers. Have the students practice this skill by listening to your stories first, then, telling you what to write on the board. Have them tell you how they arrived at the number sentences they used. Example: Rick and Ward were fishing. Ward caught seven fish, but Rick caught nine fish. How many more fish did Rick catch than Ward? 9-7=2.
- Add extraneous information that will need to be ignored in order to create the number sentence. Example: Dalene and Stacey were playing with their three dogs in the back yard. One of the dogs found two balls. One dog found a new kitten. How many dogs and children were playing in the back yard? Have the students write the number sentence using only the numbers needed to answer the question.
- Create seasonal story mats that the students can use to tell addition and subtraction stories. Use seasonal candies as counters on the mats. Have the students create number sentences to answer the questions. Students will then write them on small pieces of paper that can be stapled into tiny books to be taken home. Example: Use candy corn at Halloween to tell number stories.

Can the student compare numbers using the language of algebra?

- Using connecting cubes or base ten blocks, show two numbers (Example: four and six) and ask the student questions such as, “Which number is greater/less than the other? Which number is more/less? Are the numbers equal to each other, or are they almost the same?” The student answers using the language of algebra such as, “Six is greater than four, or four is less than six.”
- Play the game of War for two to four students. Use a deck of playing cards or teacher-made dot cards/number cards stacked face down on the playing surface. Each student draws a card from the top of the deck and turns it over to show the amount. Students evaluate the cards by saying, “My number is greater than Lynn’s, but less than John’s, etc.” The student who has the greater number wins the turned-over cards. Play continues until all the cards are gone. The student with the most cards wins, or a greater than/less than spinner could be used to determine whether the winner is the one with the most or the one with least cards.

Can the student see the relationship between addition and subtraction?

- Create a connecting cube train using two colors. Write an addition sentence and a subtraction sentence for the train. For example using maroon and white cubes: mmmwwww could become 3+4=7 and 7-3=4.
- After they have had several days to explore this concept of reversal of operations, have the students make recordings of the equations they have found. At this time they can be encouraged to write two addition and two subtraction facts for each number train.
- Explore fact families. Give the students a simple equation such as 4+5. Have them complete the number sentence and generate one more addition sentence and two subtraction sentences using the same numbers. Example: 4+5=9 and 5+4=9; 9-5=4 and 9-4=5. Have the students make recordings of the equations they found.

Standard 02: Evaluate algebraic expressions.
Content Knowledge and Skills:
a. Explore and use the commutative property of addition.

Can the student use the commutative property of addition?

- Show a set on a two-part mat on the overhead projector. Ask the students to say the addition name for how much is shown. For example: eight + four. Have the students watch carefully as you turn the mat around changing the equation to four + eight. Ask the students for the addition name, "Four + eight." Discuss which is more 8 + 4 or 4 + 8? Ask if this will work for other numbers, really big numbers.
- Following up on the previous activity, provide connecting cubes in two colors for the students to explore the same concept.
- Using two colors of connecting cubes, have the students build number trains (connected cubes lying flat on a surface are called "trains"). For example: 3 yellow and 4 brown would be yyybbbb which creates the equation 3+4=7; flipping it around makes bbbbyyy – the number sentence 4+3=7. Display those two equations and continue to explore other possibilities for seven, such as yybbbbb, ybbbbbb, etc.
- Put the previous activity in a center for students to explore further.

273. Functions and Mathematical Models.

Standard 01: Understand the concept of functions.
Content Knowledge and Skills:
a. Extend patterns and identify the rule (function) that creates the pattern.
b. Sort and classify objects by more than one attribute.
c. Understand and use appropriate vocabulary.

Can the student identify and extend the rule that creates the pattern?

- Create a learning center using stamps and stamp pads. Have the students extend patterns found on task cards at the learning center. Share in pairs.
- Using holiday colors of construction paper cut into 1"x6" strips, make paper chains using a pattern. Have each student explain his-or-her individual pattern to the class.

Can the student sort and classify objects by more than one attribute?

- Read "The Lost Button" in *Frog and Toad Are Friends* by Arnold Lobel. Discuss how Toad lost his button and Frog tried to help him find it. Play the Lost Button Game with the students. Lay out a pile of buttons. Make sure that one of the buttons has a duplicate. Hide the duplicate in your hand. Have one student pick up a button and ask a question to see if it is your button. For example: "Is this your button, Toad?" Answer: "No, that button is round, mine is square." Have the students continue to ask you

questions so that the attributes are narrowed to those of the button you are hiding. Put this game in the learning center for students to play. (Hint: if you don't have buttons, invite the students to help you create a button box by bringing button from home for a school collection.)

Can the student use the language of algebra, patterns, and functions?

- As the students use the algebra and patterning activities, encourage them to use language such as pattern, sort, greater than, less than, same as.

Geometry

271. Concepts and Principles of Geometry.

Standard 01: Apply concepts of size, shape, and spatial relationships.
Content Knowledge and Skills:
a. Recognize, name, build, draw, compare, and sort two-and three-dimensional shapes.
b. Recognize and create shapes that have symmetry.
c. Explore slides, flips, and turns.
d. Understand appropriate vocabulary (cone, cube, cylinder).

Can the student name, build, draw, compare, and sort two and three-dimensional shapes?

- Provide a class set of shape cards and geoboards with geobands for each student. The teacher will show a shape card and have the students reproduce it on a geoboard. After some successful practice, move the activity to a learning center for students to practice independently.
- Provide a set of two and three-dimensional shapes varying in size. Have the students sort and classify the shapes according to their attributes.

Can the student recognize and create shapes that have symmetry?

- Find examples of symmetrical objects in the classroom, such as the classroom windows, storage cubbies for the students, etc. Discuss what properties make them symmetrical.
- Provide pre-cut four-inch letters. Distribute them to the students. Have each student fold a letter to see if the two halves match exactly. Make a chart labeled symmetrical/non-symmetrical and have each student place his-or-her letter in the correct category. Discuss the results.

Can the student explore slides, flips, and turns?

- Go for a walk around the school looking for examples of tessellations such as floor tiles, brick walls, etc. Discuss the properties that make tessellating figures link together with no spaces in between.
- Provide samples of wallpaper and wrapping paper. Have the students look for examples of tessellations in the samples. Sort into categories.
- The Math Counts series by Henry Pluckrose includes one book called *Shape*. In that book is a section on tessellations that shows some examples of this math concept.

Can the student use the language of geometry?

- As the students use the geometry activities, encourage them to use language such as cone, cylinder, and cube to describe the shapes.

Data Analysis and Probability

272. Data Analysis, Probability, and Statistics.

Standard 01: Understand data analysis.
Content Knowledge and Skills:
a. Interpret information found in simple graphs to answer questions.
b. Understand and use appropriate vocabulary (tally, predict).

Can the student interpret information found in graphs to answer questions?

- Provide a graph titled "How do students in first grade come to school?" Have the students look for particular parts of the graph, such as: the question in the title, the columns with labels at the bottom, the numbers designating the rows on the left of the graph. Guide them to look at the graph and make comparisons between the columns of information.
- Provide different types of graphs such as picture graphs, tally graphs, and bar graphs in vertical and horizontal formats. Look for all the parts of each graph as described previously.

Can the student understand and use the vocabulary of data analysis?

- As the students use the data analysis activities, encourage them to use language such as tally and predict.

Standard 02: Collect, organize, and display data.
Content Knowledge and Skills:
a. Gather and display data in graphs in order to answer a question.

Can the student gather and display data in graphs to answer a question?

- Create a graph as a class. Provide assorted fruits and a large floor grid for graphing. Have the students predict which fruit will be the favorite in the class. Write the title of the graph as decided by the students. Have each student choose his-or-her favorite fruit and place it on the floor graph in columns labeled with pictures of the fruits. Discuss the results using the language of data analysis.
- Provide a large blank grid. Tell the students that they are going to create a graph about favorite ice cream flavors. Decide together on a question to answer for the title such as : What is your favorite ice cream? Have each student write his-or-her name on a sticky note and place it in the appropriate row to create a bar graph indicating a favorite ice cream flavor. Discuss the results using the comparative language of data analysis.

Standard 03: Understand basic concepts of probability.
Content Knowledge and Skills:
a. Predict, perform and record results of simple probability experiments.

Can the student predict, perform, and record results of simple probability experiments?

- Provide a class calendar and weather symbols. Ask the students to make predictions about how many days it will rain (snow) the following months. Use your calendar to record the data and compare the results. Students can keep individual calendars to record their own results. Discuss the results at the end of the month using the language of probability.

- Provide tooth-shaped poster boards for prediction and one for recording actual teeth lost. Ask the students to predict how many students will lose a tooth during the next month. Record the results and compare them with the predictions using the language of probability.

Standard 04: Make predictions or decisions based on data.
Content Knowledge and Skills:
a. Make predictions or decisions based on probable results or past experiences.

Can the student make predictions or decisions based on probable results?

- See suggestions in the previous standard.

268. Mathematical Reasoning and Problem Solving

Standard 01: Understand and use a variety of problem solving skills.
Content Knowledge and Skills:
a. Select strategies appropriate to solve a problem.
b. Select and use appropriate operations.

Standard 02: Use reasoning skills to recognize problems and express them mathematically.
Content Knowledge and Skills:
a. Draw a picture and generate a number sentence from a problem solving situation.

Standard 03: Apply appropriate technology and models to find solutions to problems.
Content Knowledge and Skills:
a. Select appropriate models to represent mathematical ideas.

Standard 04: Communicate results using appropriate terminology and methods.
Content Knowledge and Skills:
a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models to communicate mathematical information.
b. Use appropriate vocabulary to communicate mathematical information (draw, write, show, tell).

Can the student use mathematical reasoning and problem solving strategies?

- Problem-solving strategies and processes are not so much taught as *modeled*. Your task as a teacher is to suggest appropriate strategies and to point them out to students in class discussions as important ways of doing mathematics. – (Van de Walle, 2001)

  The **before** phase: To model problem-analysis skills for your students, first discuss what is known, what is needed, and what is asked for or expected in the task. From this discussion students will begin to understand that this is an important first step in the problem solving process.

  The **during** phase: At this time invite students to contribute their methods for solving the problem. Different students may have different ideas about how to approach the task. All possible strategies should be accepted and respected as part of the learning process. Give students the opportunity to use *their* ideas and not simply follow directions. Trust and encourage the students' creative thinking.

The **after** phase of problem solving should include a discussion highlighting the strategies used to complete the task. By labeling a strategy, students are provided with a useful way to talk about their methods, and the teacher is given a means to provide hints and suggestions.

The **final** phase of problem solving must include modeling the "looking back process" in order to justify the answer, consider how the problem was solved and look for possible extensions or generalizations. It is important to model this part of problem solving as students will be expected to complete this phase independently in subsequent grades.

- Some of the strategies that are useful for first grade students could be:
  1) Draw a picture, 2) act it out, 3) use a model, 4) look for a pattern, 5) make a table, chart, or graph, and 6) guess and check.

Suggested Teaching Strategies for Second Grade

Number Sense

277. Basic Arithmetic, Estimation, and Accurate Computations.

Standard 01: Understand and use numbers.
Content Knowledge and Skills:

a. Demonstrate knowledge of our numeration system by counting in a variety of ways.
b. Read, write, order, and compare whole numbers to 1,000.
c. Demonstrate the knowledge of place value through 999.
d. Determine, by counting, the value of a collection of pennies, nickels, dimes, and quarters, up to $1.00.
e. Explore decimals, using money, through hundredths.
f. Understand and apply appropriate vocabulary (digit, hundreds, thousands, numeral, even, odd, place value).

Can the student count in a variety of ways?

- *Two Ways to Count to Ten* by Ruby Dee, is an African folktale about King Leopold who is in search of the most suitable animal to marry his daughter. It is the perfect lead-in for exploring skip counting. For example: Can you count to ten by fours? Can you count to ten by threes? How else can you count to ten? How many ways can you count to 38? What numbers can you reach if you count by fives? Students can use counters to help them work with this problem of counting in different ways. They could also use the hundreds chart.
- *The King's Commissioners* by Aileen Friedman is another good book to use for exploring counting in a variety of ways. This is a funny book about a little girl who helps her father, the king, learn that there is more than one way to count. After reading the book together, discuss how the king is confused about the counting because he doesn't understand how to skip count. Practice skip-counting together using different patterns such as twos, fives, tens, hundreds, etc.
- Have students practice skip-counting starting with a number other than zero. For example: counting by twos beginning at 5 would be 5, 7, 9, etc.
- Have students skip-count backwards to increase the difficulty of the task.
- Dramatize this activity by counting in different voices, such as old man, baby, ghost, Santa Claus, etc.

Can the student read, write, order and compare whole numbers to 1,000?

- Have the students write down some odd numbers between 0 and 100. Check that all the numbers the students write are odd. Do they record them haphazardly or methodically? (Sullivan & Lilburn, 2002)
- Continue the previous activity and extend the numbers to 1,000 on a gradual basis.
- The activities listed under place value overlap with this concept and may be used for either one.

Can the student demonstrate knowledge of place value through 999?

- Ask the students, "What do you know, and what can you find out about he number 180?" Accept any suitable responses. Question further any students who do not include a response that shows their awareness of place value, for example, 180 is 100+80, or 18 groups of 10, etc. (Sullivan & Lilburn, 2002)

- Play “Make the Greatest Number” by having the students draw three lines upon which they will line up their playing cards (__ __ __). Use two decks of teacher-made cards with the numbers 0-9 (or one deck of playing cards ace-nine). The students take turns drawing a card and placing that card on one of the lines as one of the digits in the number he or she is building. After each student has completed building a three-digit number, they compare numbers to see who has won that round. They can find the winner after ten rounds.
- A variation on the activity above would be to play “Make the Least Number” using the same rules.
- Another variation would be to draw four cards. As cards are drawn, the student must decide when to use the option of discarding one card. The game can be played to create the greatest number or the least number.

Can the student count a collection of pennies, nickels, dimes, and quarters up to a dollar?

- *Math by All Means: Money Grades 1-2* by Sharon Crawford, is a replacement unit for teaching money. There are many ideas for creating centers using money.
- Have students put a mixed group of coins (pennies, nickels, dimes, and quarters) in a small container. With a tablespoon, students scoop out one spoonful of coins, count the value of the collection, and draw circles with the coin values inside to record their findings.
- Practice using money by creating a store for students to purchase supplies to make an art project such as a Valentine card, Mother’s Day gift, etc.
- The teacher can model solving coin collection problems using the overhead projector, 00-99 chart transparency, and overhead coins. Select a collection of coins to be counted. Have the students tell you which coin has the greatest value; then, place that coin on the appropriate space on the chart. Example: with the collection of a quarter, two dimes, and two pennies; put the quarter on the 25. Discuss the value of this part of the collection (25 cents so far). Put the first dime on 35 and determine the value of the collection with this addition (35 cents). The second dime goes on 45 (45 cents), the first penny goes on 46 (46 cents), and the remaining penny goes on 47 (47 cents) with discussion taking place at every addition. Then, you have counted the collection by noting the number that the last coin sits on – or in this case 47 cents.
- Provide a coin collection (or have them make their own by using a tablespoon) and a 00-99 chart. Have the students practice using the previously modeled activity at their desks or in a center.
- Learn the poem, *A Penny is One Cent*.

  A penny is one cent, (stamp your foot once)
  A nickel is five, (slap your thigh once)
  A dime is ten cents (clap your hands once)
  A quarter - twenty-five. (snap your fingers above your head once)
  How many cents have I on this try?

  The teacher creates a combination of motions that represent a collection of coins for the students to identify. Begin with the coin of greatest value. For example: clap, clap, slap, stamp would be dime, dime, nickel, penny. The collection is worth 26 cents. Students raise their hands at this point to state the value of the collection.

Can the student apply decimals using money through hundredths?

- Construct holiday cards using a planning sheet and an order sheet. Using the planning sheet, have the student design a Valentine (or other holiday) card. On the order sheet,

the student lists the supplies needed and their prices using the decimal format rather than the cent sign. For example: five cents would be $ .05.

Can the student use the language of number sense?

- Using the activities listed under number sense, encourage the students to use the appropriate mathematical vocabulary. Listen for the terms: digit, hundreds, thousands, numeral, even, odd, place value, etc.

Standard 02: Perform computations accurately.
Content Knowledge and Skills:
a. Demonstrate proficiency with addition and subtraction facts through 18.
b. Add whole numbers with and without regrouping through 99.
c. Add a series of one-digit addends.
d. Explore double-digit subtraction of whole numbers with regrouping through 99.
e. Use appropriate vocabulary (equation, sum, difference, plus, minus, addends).

Can the student add and subtract facts through 18 proficiently?

- Help the students begin to develop strategies for addition. According to Van de Walle, "The use of doubles (double 6 is 12) and near doubles (13 is double 6 and 1 more) is generally considered a strategy for memorizing basic addition facts. There is no reason why children should not begin to develop these relationships long before they are concerned with memorizing basic facts. Doubles and near-doubles are simply special cases of the general part-part-whole construct." Here are some of the doubles you can use or adapt to use with your students. Have your students draw pictures for an individual booklet or posters for your classroom. Double 3 is the bug double: 3 legs on each side. Double 4 is the spider double: 4 legs on each side. Double 5 is the hand double; two hands. Double 6 is the egg carton double; two rows of six eggs. Double 7 is the two-week double: two weeks on the calendar. Double 8 is the crayon double: two rows of eight crayons in a box. Double 9 is the 18-wheeler double: two sides, nine wheels on each side.
- Play "Finding Sums" from *Nimble With Numbers*. On a piece of paper, write the numbers 2 through 12. Roll a die four times. Write down those four numbers on cards. Using the four cards, find sums and cross them off your list of numbers 2-12. For example: if you roll 2, 3, 4, 6, you can add 2+6 to cross off 8, 3+4 to cross off 7, 2+3 to cross off 5, etc. Keep adding two cards together until you have used up all the possibilities. The leftover numbers which sums could not be made for in the 2-12 list are then added together. That is your total score. Compare your total score with others playing the game. The lowest total score wins. (Childs & Choate, 1998)
- Provide four sets of number cards, 0-9, for each pair of students. After shuffling the cards, have the pairs divide them evenly. Each player must lay his or her cards in a stack face down. In unison, the partners count to three; then, each player turns over the top card of his or her stack. The students must add the two numbers. The first student to state the sum correctly collects both cards. Continue the process until all cards are turned over. The object is to get the most cards.
- A variation on the previous activity would be to use two sets of cards numbered 0-18. Then a subtraction game could be played using somewhat the same directions.
- Play "Three in a Row" adapted from *Math Sponges*. Each student needs scratch paper and nineteen cards numbered 0-18, which are put into a paper bag. On their scratch paper, students draw a three by three grid (like a Tic Tac Toe form with a border) and write in only nine of the numbers from 0-18 using each number only once. A number card is picked from the bag and a clue for that number is read. For example: 12, the

number of ears on six rabbits; 10, the number of sides on two triangles and one square. The object is to cover three in a row on their grids. When one child has a Bingo, keep the game going to see if others can get three in a row before he gets another Bingo. If time allows, play continues until someone covers the whole grid and gets a blackout. (Childs & Adams, 1979)

- Another game from *Math Sponges* is "Fast Math." The teacher gives a verbal on-going problem, and the students try to keep up with the answer. Start with 6, add 3, add 6, subtract 2, add 4, etc. For a variation, "Slow Math" can be used with students needing more time. Use a slower pace and smaller numbers. (Childs & Adams, 1979)
- Write down everything you know about a particular number. For example: 12, the number of eggs in a dozen, 8 + 4, 14 –2, etc. Repeat this activity using other numbers.

Can the student add whole numbers to 99 with and without regrouping?

- Provide a hundreds chart and counters for each student. Model solving the problems using the overhead and hundreds chart transparency. Write the problems on the overhead. Example: 28+36=? Place the counter on number 28. Slide down three spaces (to add three tens). Move forward six spaces (to add the six ones). Now you are at 64. After modeling, have the students work in pairs to add two-digit numbers.
- Create a math problem on the overhead. Have the students play teacher and determine whether the problem was correctly solved. If there is an error, the students try to identify where it is and how it occurred.
- Make a center for the students to create problems for their classmates to solve. These could be taken to the overhead for a group discussion in a future lesson.
- Give the students a two-digit addition problem and have them interpret it with manipulative materials. Using this method in a whole group setting, give only the first number in the problem by saying it and writing it on the board. Have all students build that number with manipulatives. Then, write the second number in the equation and have them solve. Watch which methods they use to solve the problems. Do they count every number? Do they count by twos or fives? By tens? Do they count on? (Richardson, 1999. Book 3)

Can the student add a series of one-digit numbers?

- Using the strategies of *make a ten*, *double, doubles plus one*, or others that may be helpful, have the students determine which two numbers to add first to in order complete the addition. This series may be presented in a horizontal or vertical format; therefore, students should be given the opportunity to practice both kinds of problems.

Can the student subtract whole numbers through 99 with and without regrouping?

- Provide a hundreds chart and counters for each student. Model solving the problems using the overhead and hundreds chart transparency. Write the problems on the overhead. Example: 45-12=? Place the counter on number 45.Slide down one row (this is to subtract the ten). Move backwards two spaces (to subtract the 2 ones in 12). Now you are at 33. After modeling, have the students work in pairs to subtract two-digit numbers.
- Create a math problem on the overhead projector. Have the students play teacher and determine whether the problem was correctly solved. If there is an error, the students try to identify where it is and how it may have occurred.
- Make a center for the students to create problems for their classmates to solve.

Can the student use the language of computation?

- As students complete the activities listed under computation, listen for the use of mathematical terms such as, equation, sum, difference, plus, minus, and addends.

Standard 03: Estimate and judge reasonableness of results.
Content Knowledge and Skills:
a. Use estimation to predict computation results.
b. Evaluate the reasonableness of an answer.
c. Use appropriate vocabulary.

Can the student use estimation to predict the results of computation?

- Using the overhead projector, display equations to be estimated for about 2-5 seconds. The students are not given paper and a pencil; rather they must rely on their ability to do mental math by using strategies such as rounding to the nearest ten or the nearest dollar. The equations given and the time allowed will vary according to the time of school year as well as the mathematical strengths of the students.

Can the student evaluate the reasonableness of an answer?

- Given the equation 11-8=17, students could evaluate the reasonableness of this answer by referring back to the minuend. The difference could not be larger than the minuend; therefore, the student could see this was not a reasonable answer. Guided practice in judging the reasonableness of answers is necessary in order to have students become proficient in judging their own answers.

Can the student use the language of estimation?

- As students use estimation activities, encourage the use of the correct mathematical terminology: estimate, reasonable, predict,

Measurement

279. Concepts and Principles of Measurement.

Standard 01: Understand and use U.S. customary and metric measurements.
Content Knowledge and Skills:

a. Explore the use of standard and non-standard tools for measuring time, length, volume, weight, and temperature.
b. Apply estimation of measurement to real-world and content problems using actual measuring devices.
c. Tell time using both digital and analog clocks to the quarter hour.
d. Explore the relationship among units of time.
e. Use appropriate vocabulary (centimeter, meter, inches, feet, yard, weigh, pounds, minutes, hours, temperature, degrees).

Can the student use standard and non-standard tools for measuring time, length, volume, weight, and temperature?

- Students can use cubes, straws, books, and toothpicks to measure lengths of different body parts such as arms, legs, feet, fingers, etc.
- Show the students five bottles. Using their estimation skills, have them help you put them in order according to their volume. Have the students check their estimates using rice, beans, or water, and reorder the bottles according to the actual volume measurements.
- Put the activity listed above into a center with a box of containers of various sizes and shapes. Have the students complete the activity by estimating first and checking their estimates.
- Provide various containers, a cup, and a tub filled with rice or water. Ask students to estimate then measure the number of cups various containers will hold. For example: how many cups will a quart container hold? Or, have them determine which containers hold more (or less) than a cup.
- Have each student measure a partner and record the height on a classroom chart every three months throughout the school year. Discuss the results periodically.
- Mount a thermometer outside the classroom door, or move a portable thermometer outside the classroom for about 15-20 minutes each day. Bring it back in to read. Have students observe and record the temperature daily determining whether it is a hot day or a cold day.

Can the student use estimation in real-world and content measurement problems?

- *Counting on Frank*, by Rod Clement, is a story where the narrator and his dog, Frank, experience estimating everyday things in unusual ways such as, how long of a line can the average ballpoint pen draw or how many Franks would fit in the bedroom. The estimating is fun and fanciful. Students could make their own book using estimations class members contribute.
- Using lengths of string, students will create two shapes. They will estimate which will hold the most cubes (tiles, blocks) and which will hold the least. Using the manipulative they have chosen, they will fill the spaces to check their original estimates.
- After practicing with the more/less concept, students can move to an actual numerical estimate for each shape. They could make three estimates: how many cubes will each of the two shapes hold and what the *difference* is between the number of cubes in each shape? After estimating, and checking their estimates for the number of cubes in each shape, they can make an equation to see if their estimated *difference* is close.

Can the student tell time to the quarter hour using digital or analog clocks?

- Play a memory game matching cards with analog times and cards with digital clock times.
- Provide the students with individual clocks. Write a time on the board, example: 3:00. Ask student to read it and show fifteen minutes before that time (and after that time) on their clocks. Students compare their clocks with a partner and say that time aloud.

Can the student see relationships among units of time?

- Play a memory game using different time terminology such as: a card with “5:45” and a card with “a quarter to six” are a match.
- Provide a bound calendar book (set of blank calendar pages from August to July) for each student and a large class calendar book to use as a teaching model. On the first of the current month, have the students write the dates in the current boxes. Add the birthdays of class members, holidays, special events, etc. Pull out the calendar books frequently and ask questions such as, “ What day is a week from tomorrow? What is the date of the second Friday? Which month will be next? How many Tuesdays are in this month?

Can the student use the language of measurement?

- As students complete the measuring activities, encourage them to use measurement terms such as: centimeter, meter, inches, feet, yard, weigh, pounds, minutes, hours, temperature, and degrees.

Patterns / Algebraic Thinking

280. Concepts and Language of Algebra.

Standard 01: Use algebraic symbolism as a tool to represent mathematical relationships.
Content Knowledge and Skills:
a. Represent vertical notation in horizontal form.
b. Write a number sentence given an addition or subtraction problem.
c. Compare numbers using vocabulary (less than, greater than, equal to) and symbols (<, >, =).
d. Understand the relationship between addition and subtraction and demonstrate reversal of operations.

Can the student represent vertical notation in horizontal form?

- As the students use notation, have them use both forms interchangeably. Generally, the horizontal form is easier. Practice using both forms interchangeably on a daily basis.

Can the student write a number sentence when given an addition or subtraction problem?

- Display interesting pictures. Have the students make up word problems that go with the pictures. Increase the difficulty by adding operational requirements or adding number limitations such as; “Think of a problem that has an answer of 23.” Write the equations for the stories on the board as you go having the students explain how they got the numbers.
- Continuing from the first activity, gradually use larger numbers in more complex problems. Add extraneous information that will need to be ignored in order to create the correct number sentence.

Can the student compare numbers using the language of algebra?

- Play the game of Double War. The game of Double War is played like War, but on each play both players turn up two cards instead of one. The winner is the one with the larger total number. Students playing the game can use many different relationships to determine the winner without actually finding the total number of dots. Listen as students play to hear them using the language of algebra. (See First Grade for directions for playing War.)

Can the student understand the relationship between addition and subtraction?

- Provide each student with a pipe cleaner and ten pony beads (available at craft stores). Have the students string the beads on the pipe cleaner. Work with different problems using the beads as a manipulative. Example: have the students pull four beads to the left side leaving six on the right. Have them state an addition equation. Continue by having them state a subtraction equation by covering up one side of the divided beads to discover how many are left. Different numbers can be explored by changing the number of beads on the pipe cleaner. Put the materials in a center for students to explore further.
- Continue the previous activity by having the students make recordings of the equations they have found after they have had several days to explore this concept of reversal of operations. At this time they can write two addition and two subtraction facts for each number combination.

Standard 02: Evaluate algebraic expressions.
Content Knowledge and Skills:
a. Explore and use the commutative property of addition.

Can the student use the commutative property of addition?

- Show a set on a two-part mat on the overhead projector. Ask the students to say the addition name for how much is shown. For example: eight + four. Have the students watch carefully as you rotate the mat changing the equation to four + eight. Ask the students for the addition name, "Four + eight." Discuss which is more 8 + 4 or 4 + 8? Ask if this will work for other numbers, really big numbers?
- Following up on the previous activity, provide connecting cubes in two colors for the students to explore the same concept. Put the activity in a center for students who need more practice.

283. Functions and Mathematical Models.

Standard 01: Understand the concept of functions.
Content Knowledge and Skills:
a. Extend patterns and identify the rule (function) that creates the pattern.
b. Sort and classify objects by more than one attribute.
c. Understand and use appropriate vocabulary.

Can the student extend patterns and identify the rule that creates the pattern?

- Create a daily pattern section of the board. Have the students study a pattern and supply the next number, character, or shape. Be sure to make the pattern that is written continue for at least 2 ½ repetitions. For example: 5, 10, 15, _, _, _. Or, 1, 3, 5, 7, 9, _, _, _. Or, __, __, 7, 10, 13, 16, __. Use student-authored patterns making sure that the patterns have begun to show repeats. (Childs & Adams, 1979)
- Have the students study the given relationship. 1:3 as 5:? They try to discover the relationship of the first two numbers and complete the missing part so that the last two numbers relate similarly. (1:3 as 5:7**)** After students understand the activity, include student-authored patterns. (Examples: 70:60 as 40:? 2:4 as 9:?) In the last example 2:4 as 9:?, the answer could be 18 if doubling, or 11 if adding on two. Students would be correct with either answer, but they must explain their thinking. (Childs & Adams, 1979)
- Counting in different ways is also an excellent example of patterning. Students must know the pattern of the numbers in order to count in a variety of ways. They could be given a series of patterned numbers with errors to find.

Can the student sort and classify objects by more than one attribute?

- Read *The Button Box* by Margarette S. Reid to the class. In this book, a boy sorts his grandmother's buttons in many ways. After reading, students can sort buttons from your button box. Have them draw the buttons and write about how they sorted them. Then, they can think of another way to sort and write about why they chose to sort that way. If you don't have buttons, invite your students to help you make a collection. They can bring odd buttons from home to put in the classroom collection. Also, thrift stores are a good source for used buttons. (Larkin & Perez, 2004)

Can the student use the vocabulary of rules (functions)?

- As students use the function activities, encourage the use of correct terminology.

Geometry

281. Concepts and Principles of Geometry.

Standard 01: Apply concepts of size, shape, and spatial relationships.
Content Knowledge and Skills:
a. Recognize, name, build, draw, compare, and sort two-and three-dimensional shapes.
b. Recognize and create shapes that have symmetry.
c. Explore slides, flips, and turns.
d. Understand appropriate vocabulary (symmetry, side, sphere, edge, face).

Can the student recognize, name, build, draw, compare, and sort two- and three-dimensional shapes?

- Have the students create riddles about shapes to play the game "What Am I?" The child gives a clue(s) about a shape. The group guesses the identity of the shape. (Childs & Adams, 1979)
- Read *The Greedy Triangle* by Marilyn Burns. Discuss the properties of a triangle as well as the other shapes the triangle changes into. Provide toothpicks for students to experiment with in creating the various shapes as the story is read. Also provide each student with a geoboard and a large geoband. Ask students to create a triangle. As the story is read have the students become the "shape changer" and change the shape of the triangle. Stop after each change and discuss the ways the shape is the same and/or different than it was before.
- Give the students a set of regular and irregular shapes to sort according to their properties. They might sort by regular/irregular shapes, curved/not curved lines, or 3 sides/not 3 sides. After sorting, have the students tell you how they sorted. Then, have them resort the shapes in another way using other properties.

Can the student recognize and create shapes that have symmetry?

- Give each pair of students a 9x12 piece of construction paper with a line drawn vertically through the center. One student begins at the line and creates a design using pattern blocks on the left-hand side. Another student duplicates this design beginning at the line of symmetry and working on the right-hand side of the paper. The symmetry of the completed design can be verified by standing a mirror on the vertical line facing it toward the left half of the paper.

Can the student explore slides, flips, and turns?

- Give the students pattern blocks. Have them explore the different shapes and how they can fit together to tile a surface.
- Give each student a three-inch square piece of construction paper. Have the student cut a piece out of one side beginning at a corner, curving in towards the center of the square and back out to the adjacent corner. The straight side of this piece is then slid and taped to the straight edge on the opposite side of the three-inch square creating a new shape. The new shape can be slid and traced to tile a 9x12 piece of construction paper. After tiling, the student can color in the page with different colors, or create a pattern of colors such as those found on a floor, etc.

Can the student use the language of geometry?

- Have a student select a two- or three-dimensional shape without letting the other students see the selection. The student describes the chosen shape using the language

of geometry such as: symmetry, side, edge, and face. The other students will guess the name of the chosen shape by analyzing its attributes.

- Play the game of 20 questions. A student chooses a shape as described above, but doesn't describe it. The other students try to figure out the shape by asking questions using geometric terms.

Data Analysis and Probability

282. Data Analysis, Probability, and Statistics.

Standard 01: Understand data analysis.
Content Knowledge and Skills:
a. Interpret information found in simple tables, charts, and graphs.
b. Understand and use appropriate vocabulary (row, column).

Can the student interpret the information found in tables, graphs, and charts?

- Given a set of data and three different graphs, students will look at the data given and determine which of the three graphs could be used to display that data.
- Provide different types of graphs, charts and tables. As a class, practice interpreting the information found in each sample. Put samples in a center for students to practice individually.

Can the student understand and use the vocabulary of data analysis?

- As the students use the data analysis activities, encourage them to use mathematical language such as row and column.

Standard 02: Collect, organize, and display data.
Content Knowledge and Skills:
a. Gather and display data in tables, charts, and graphs in order to answer a question.

Can the student gather and display data to answer a question?

- Create a graph using data collected by watching cars traveling down a street that borders a fenced section of the school playground. As a class, make estimates about which color will prove to be the most popular. Pair the students and instruct them to tally the colors of cars that drive past the school during a 15-minute period. Clipboards are handy tools for keeping this information organized. One child can count the cars while the other tallies/records the data. After 15 minutes, return to the classroom and instruct the pairs to create a graph using their own data. Compare the results from the pairs of students. Check estimates made by the class. Discuss differences that may occur in reported data from the different pairs of students.
- Read the book *Whistle for Willie* by Ezra Jack Keats. After a discussion on whistling, conduct a survey of the number of students who can whistle and who cannot whistle. This could be a large survey such as all the second graders in the school. Create a graph using the results. Hang the graph in the second grade hall.

Standard 03: Understand basic concepts of probability.
Content Knowledge and Skills:
a. Predict, perform, and record results of simple probability experiments.

Can the student predict, perform, and record the results of probability experiments?

- Play “What’s The Record?” by rolling two dice and tallying the number of rolls made before doubles appear. The challenge is to be the student who rolls the most times before getting doubles. On a class chart, record how many rolls the winner made. Continue this activity for a week or more, and/or compete with another second grade class to see what the greatest number of rolls is. (Burns, 1992. About Teaching Mathematics: A K-8 Resource)

Standard 04: Make predictions or decisions based on data.
Content Knowledge and Skills:
a. Make predictions or decisions based on probable results or past experiences.

Can the student make predictions or decisions based on probable results or past experiences?

- In pairs, predict which number will come up the most times when rolling a die ten times. Conduct the experiment by tallying the number that appears as the die is rolled. Before conducting the experiment a second time, predict if the results will be the same. Conduct the experiment and compare the results.
- Play "Two-Coin Toss" by tossing two coins together 25 times. After each toss, students will record what comes up: two heads, two tails, or one head and one tail. Have students predict the results before they begin the experiment. Discuss the results. Note: If you toss just one coin, there are two possible outcomes: heads and tails. If you toss two coins, there are four possible outcomes. What are they? (Burns, 1992. About Teaching Mathematics: A K-8 Resource)

278. Mathematical Reasoning and Problem Solving

Standard 01: Understand and use a variety of problem solving skills.
Content Knowledge and Skills:
a. Select strategies appropriate to solve a problem.
b. Select and use appropriate operations.

Standard 02: Use reasoning skills to recognize problems and express them mathematically.
Content Knowledge and Skills:
a. Generate a number sentence from a problem-solving situation.

Standard 03: Apply appropriate technology and models to find solutions to problems.
Content Knowledge and Skills:
a. Select appropriate models to represent mathematical ideas.

Standard 04: Communicate results using appropriate terminology and methods.
Content Knowledge and Skills:
a. Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models to communicate mathematical information.
b. Use appropriate vocabulary to communicate mathematical information.

Can the students use mathematical reasoning and problem solving strategies?

- Problem-solving strategies and processes are not so much taught as *modeled*. Your task as a teacher is to suggest appropriate strategies and to point them out to students in class discussions as important ways of doing mathematics. (Van de Walle, 2001)

  The **before** phase: To model problem-analysis skills for your students, first discuss what is known, what is needed, and what is asked for or expected in the task. From this discussion students will begin to understand that this is an important first step in the problem solving process.

The **during** phase: At this time invite students to contribute their methods for solving the problem. Different students may have different ideas about how to approach the task. All possible strategies should be accepted and respected as part of the learning process. Give students the opportunity to use *their* ideas and not simply follow directions. Trust and encourage the students' creative thinking.

The **after** phase of problem solving should include a discussion highlighting the strategies used to complete the task. By labeling a strategy, students are provided with a useful way to talk about their methods, and the teacher is given a means to provide hints and suggestions.

The **final** phase of problem solving must include modeling the "looking back process" in order to justify the answer, consider how the problem was solved, and look for possible extensions or generalizations. It is important to model this part of problem solving as students will be expected to complete this phase independently in subsequent grades.

- Some of the strategies that are useful for second grade students could be:
  1) Draw a picture, 2) act it out, 3) use a model, 4) look for a pattern, 5) make a table, chart, or graph, 6) guess and check 7) try a simpler form of the problem, and 8) make an organized list.

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If you would like a list of other children's books to use with mathematics instruction, check this website prepared at Boise State University: *http://csi.boisestate.edu/dmt/mathlit.htm*